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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/591,719	09/05/2006	Alexandr Vasilievich Garmonov	U 016390-5	3285
140	7590	08/28/2008		
LADAS & PARRY LLP 26 WEST 61ST STREET NEW YORK, NY 10023				
EXAMINER				
DONADO, FRANK E				
ART UNIT		PAPER NUMBER		
2617				
MAIL DATE		DELIVERY MODE		
08/28/2008		PAPER		

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

### Office Action Summary

**Application No.**

10/591,719

**Applicant(s)**

GARMONOV ET AL.

**Examiner**

FRANK DONADO

**Art Unit**

2617

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 05 September 2006.  
2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.  
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-22 is/are pending in the application.  
4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.  
6) ☒ Claim(s) 1-22 is/are rejected.  
7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.  
8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.  
10) ☒ The drawing(s) filed on 05 September 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☒ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)  
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)  
3) ☒ Information Disclosure Statement(s) (PTO/SF-08)  
Paper No(s)/Mail Date 12/18/06  
4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_  
5) ☐ Notice of Informal Patent Application  
6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Specification*

1. Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a **single paragraph** on a separate sheet within the range of 50 to 150 words.

2. The abstract of the disclosure is objected to for the following reasons:

a) The abstract is 2 paragraphs in length.

b) The 2<sup>nd</sup> paragraph should be changed from "...pilot signals for transmit diversity, transmitted from each adaptive antenna array in each efficient transmission direction, combining ..." to "...estimating impulse responses from pilot signals that are transmitted from each adaptive antenna array in each efficient transmission direction for transmit diversity, combining ..."

Correction is required. See MPEP § 608.01(b).

### *Claim Rejections - 35 USC § 112*

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1-22 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for

failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claims 1, 10, 11, 17 and 18, the variable  $L_{sub\ m}$  is defined as the "weighting coefficients of transmission direction" in lines 6 and 7 of Claim 1. The variable K is defined as the number of transmission channels in line 2 of claim 1. Since the examiner interprets the variable  $L_{sub\ m}$  and K as defined above, examiner requests for the phrase "... $L_{sub\ m}$  channels of directional transmission...", as stated in line 17 of claim 1, to be changed to "...K channels of directional transmission..." in claim 1 and in claims 10, 11, 17 and 18, where appropriate. Also, regarding claim 1 only, claims are narrative in form and replete with indefinite ("**such that**") and functional or operational language. The structure which goes to make up the device must be clearly and positively specified. The structure must be organized and correlated in such a manner as to present a complete operative device. The claims must be in one sentence form only. Note the format of the claims in the patent **US 6,792,290**.

Claims 4-5 and 12 recite the limitation "The method of data transmission". There is insufficient antecedent basis for this limitation in the claim. In addition, the variable  $L_{sub\ m}$  is defined as the "weighting coefficients of transmission direction" in lines 6 and 7 of Claim 1. The variable K is defined as the number of transmission channels in line 2 of claim 1. Since the examiner interprets the variable  $L_{sub\ m}$  and K as defined above, examiner requests for the phrase "...K channels of directional transmission...", as stated in line 17 of claim 1, to be changed to "...K channels of directional transmission...", where appropriate. Also, the claims are narrative in form and replete with indefinite ("**such that**") and functional or operational language. The structure which goes to make up the device must be clearly and positively

specified. The structure must be organized and correlated in such a manner as to present a complete operative device. The claims must be in one sentence form only. Note the format of the claims in the patent **US 6,792,290**.

Claims 19-21 recite the limitation "The apparatus for data transmission". There is insufficient antecedent basis for this limitation in the claim.

Claim 22 recites the limitation "The apparatus of claim 17". There is insufficient antecedent basis for this limitation in the claim. Claim 22 also recites "...the block of directional transmission...". There is insufficient antecedent basis for this limitation in the claim. Since this limitation exists in claims 19, 20 and 21, the examiner has interpreted this claim to depend on independent claims 19, 20 or 21 and has examined this claim accordingly (See below).

Claims 2, 3, 6-9, and 13-16 are also rejected by virtue of their dependency on claims 1 and 10.

### ***Claim Rejections - 35 USC § 102***

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(c) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

6. Claims 1-7 and 10-18 are rejected under 35 U.S.C. 102(c) as being anticipated by Vialle, et al (US PG Publication 2005/0117660). From now on, Vialle, et al, will be referred to as Vialle.

Regarding claims 1 and 4-5 Vialle teaches a method of data transmission, such that M diverse groups of transmission channels each having K transmission channels, where  $M \geq 1$ ,  $K \geq 1$ , are formed at the base station (**A wireless communications network has channel diversity wherein transmissions take place between a base station and a mobile station, wherein many groups of transmission channels, each group having many channels, exist, Paragraph 21, lines 1-3 and Paragraph 22, lines 1-10**), pilot signals are transmitted from the base station to the mobile station from all M. K transmission channels of diverse groups (**Paragraph 31, lines 1-2**), impulse responses of M. K transmission channels of diverse groups are estimated at the mobile station using the transmitted pilot signals (**Pilot symbols undergo a Filtered Impulse Response (FIR) filter, Paragraph 31, lines 2-4**), which differs in that Lm sets of weighting coefficients of transmission direction each having K - 1 weighting coefficients of transmission direction are formed at the mobile station (**The number of weighting coefficients per FIR Filter is set equal to the number of channels, so using the variables Lsub m and K, Lsub m = 1 and K = 1, Paragraph 44, lines 2-5**) using the estimated impulse responses of M. K transmission channels of diverse groups (**Weighting coefficients are formed from the FIR filter, the Finite Impulse Response, for each antenna in the array, Paragraph 26, lines 1-7**), where  $1 \leq L_m \leq K$  and  $m = 1, 2, \dots, M$ , for each of M diverse groups of transmission channels for each of Lm sets of weighting coefficients of transmission direction a transfer function of a channel of directional transmission corresponding to this set is estimated at the mobile station

(Transfer functions are estimated at the receiver for each channel, Paragraph 26, lines 7-10), a feedback signal containing  $L_m$  weighting coefficients of transmission direction formed for each of  $M$  diverse groups of transmission channels as well as an estimated transfer function for each of  $L_m$  weighting coefficients of transmission direction formed for each of  $M$  diverse groups of transmission channels is transmitted from the mobile station to the base station (The weighting coefficients of transmission direction are formed from the transfer function derived from the feedback signal received from the mobile station by the base station, Paragraph 26, lines 1-10 and Paragraph 30, lines 19-21),  $K$  channels of directional transmission are formed at the base station for each of  $M$  diverse groups of transmission channels using the transmitted sets of weighting coefficients of transmission direction (The weighting coefficients help to form the copies to be transmitted to the receiver for each channel, Paragraph 27. Lines 1-7), channels of signal spectrum correction are formed at the base station for each of  $M$  diverse groups of transmission channels for each of  $K$  channels of directional transmission (Power is one of the weighting characteristics used for correction of the transmission signal, and since this characteristic is re-defined for each channel at the base station, the signal spectrum is corrected, a codebook (look-up table) being used in this case to adjust the method of transmission to use the maximum power, Paragraph 33, lines 4-6 and 8-12) and their transfer functions are corrected according to the transmitted estimated transfer functions of channels of directional transmission in such a way that the reception quality of an information signal at the mobile station is maximized (Transfer functions are estimated at the receiver for each channel, and a Hermitian transformation, which is a type of Fourier transformation, takes place on the impulse response obtained from the Filtered

**Impulse Response Filter to achieve maximum power and obtain the desired transfer functions, Paragraph 26, lines 7-10 and Paragraphs 34-38).** information signal copies are formed at the base station for all K channels of directional transmission for all M diverse groups of transmission channels and all formed copies of the information signal are simultaneously transmitted over the corresponding channels of directional transmission after applying them to the respective channels of signal spectrum correction **(A copy of the “correct” signal, a signal with the needed transmission characteristics for maximum output, is produced from the above process, Column 27, lines 1-7).**

Regarding claim 2, Vialle teaches the method of claim 1, wherein all transmitted pilot signals and the information signal are mutually orthogonal or quasi-orthogonal **(The system is adaptable to be used in a Orthogonal Frequency Division Multiplexing method Paragraph 11, lines 4-8 and Paragraph 12, lines 4-6. Since the pilot signal and corrected information signal are exclusive but interference of these signals may take place, due to multipath fading, these 2 signals are quasi-orthogonal to one another, Paragraph 27, lines 1-10 and Paragraph 31, lines 1-4).**

Regarding claims 3 and 7, Vialle teaches the method of claim 1, wherein all transmitted pilot signals, pilot signals for transmit diversity and the information signal are quasi-orthogonal **(Transmit diversity takes place, and since the pilot signal and corrected information signal are exclusive but interference of these signals may take place, due to multipath fading, these 2 signals are quasi-orthogonal to one another, Paragraph 27, lines 1-10, Paragraph 31, lines 1-4 and 10-14, Paragraph 23, lines 3-7).**



Regarding claim 6, Vialle teaches the method of claim 3, wherein all transmitted pilot signals, pilot signals for transmit diversity, and the information signal are mutually orthogonal (The system is adaptable to be used in a Orthogonal Frequency Division Multiplexing method Paragraph 11, lines 4-8 and Paragraph 12, lines 4-6. Transmit diversity takes place, the pilot signal and corrected information signal are exclusive of one another, and when no interference of these signals takes place, these 2 signals are orthogonal to one another, Paragraph 27, lines 1-10, and Paragraph 31, lines 1-4 and 10-14).

Regarding claim 10, Vialle teaches the method of claim 1, wherein K channels of directional transmission are formed at the base station for each of M diverse groups of transmission channels using the transmitted sets of weighting coefficients of transmission direction in such a way that in each of K channels of directional transmission K copies of an input signal of this channel of directional transmission are formed and transmitted over the corresponding transmission channel of this diverse group of transmission channels once each copy, starting from the second one, has been multiplied by the corresponding weighting coefficient of transmission direction of the respective set of weighting coefficients of transmission direction (Correct copies of transmit signals, corresponding to each transmission channel, are transmitted once each copy has been formed from the set of FIR filters through mathematical formulas that include the multiplication of weighting coefficients by other factors for each of their corresponding channels, where "w" is the weighting coefficient that gets multiplied, wherein the series of multiplications would include all channels starting from the second one, Paragraph 27, lines 1-7 and Paragraph 33, lines 8-12).

Regarding claim 11, Vialle teaches the method of claim 4, wherein for each of M diverse groups of transmission channels an estimate of a transfer function of each of K channels of directional transmission, obtained using K pilot signals transmitted from this diverse group of transmission channels, is combined with an estimate of its transfer function, obtained using a pilot signal for transmit diversity transmitted from this diverse group of transmission channels, in such a way that these two estimates are averaged with weights that are inversely proportional to error metrics of these estimates (**A weighting coefficient, Signal-to-Noise Ratio, vs. Bit Error Rate is graphed in Figure 5, where their corresponding coordinate values are inversely proportional to each other**).

Regarding claim 12, Vialle teaches a method of data transmission, such that M diverse groups of transmission channels each having K transmission channels are formed at the base station (**A wireless communications network has channel diversity wherein transmissions take place between a base station and a mobile station, wherein many groups of transmission channels, each group having many channels, exist, Paragraph 21, lines 1-3 and Paragraph 22, lines 1-10**), where  $M \geq 1$ ,  $K \geq 1$ , which differs in that M diverse groups of receiving channels each having K receiving channels corresponding to M formed diverse groups of transmission channels are formed at the base station, a signal is transmitted from the mobile station to the base station and received at the base station in each of K receiving channels of each of M diverse groups (**A wireless communications network has channel diversity wherein signal receptions take place between a base station and a mobile station, Paragraph 21, lines 1-3 and Paragraph 22, lines 1-10**). Lsub m sets of weighting coefficients of transmission direction each having K coefficients are formed for each of M diverse groups of transmission

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channels using a signal received from the mobile station in such a way that the reception quality of the base station signal received at the mobile station is maximized, where  $L_m \geq 0$  and  $m = 1, 2, \dots, M$  (A plurality of weighting coefficients of transmission direction are produced using the pilot signals that are filtered through a Finite Impulse Response Filter, wherein optimization occurs because of the weighting coefficients, Paragraph 31, lines 1-4, Paragraph 27, lines 1-7, Paragraph 45, lines 6-8 and Fig. 5, where the Bit Error Rate is lower the more weights are used), K channels of directional transmission are formed at each of M diverse groups of transmission channels using formed sets of weighting coefficients of transmission direction (Paragraph 27, lines 1-7), pilot signals for transmit diversity are transmitted to the mobile station from each of M diverse groups of transmission channels over each of K channels of directional transmission (Paragraph 31, lines 1-2 and 10-14), transfer functions of all K channels of directional transmission are estimated at the mobile station for each of M diverse groups of transmission channels using the transmitted pilot signals for transmit diversity (Pilot signals contribute to the impulse responses through the FIR Filter, Finite Impulse Response, that contribute to the transfer function used to form the weighting coefficients of transmission direction, Paragraph 31, lines 1-4 and Paragraph 26, lines 1-10), a feedback signal containing  $L_{sub\ m}$  estimated transfer functions of directional transmission channels for each of M diverse groups of transmission channels is transmitted to the base station (The weighting coefficients of transmission direction are formed from the transfer function derived from the feedback signal received from the mobile station by the base station, Paragraph 26, lines 1-10 and Paragraph 30, lines 19-21), channels of signal spectrum correction are formed at the base station for each of M diverse groups of transmission channels

for each of K channels of directional transmission and their transfer functions are corrected according to the transmitted estimated transfer functions of directional transmission channels in such a way that the reception quality of the information signal at the mobile station is maximized (Power is one of the weighting characteristics used for correction of the transmission signal, and since this characteristic is re-defined for each channel at the base station, the signal spectrum is corrected, a codebook (look-up table) being used in this case to adjust the method of transmission to use the maximum power, Paragraph 33, lines 4-6 and 8-12), information signal copies are formed for all K channels of directional transmission for all M diverse groups of transmission channels and all formed copies of the information signal are simultaneously transmitted over the corresponding channels of directional transmission after applying them to the respective channels of signal spectrum correction (A copy of the "correct" signal, a signal with the needed transmission characteristics for maximum output, is produced from the above process, Column 27, lines 1-7).

Regarding claim 13, Vialle teaches the method of claim 10, wherein a signal transmitted from the mobile station to the base station is a pilot signal, or an information signal, or a feedback signal, or a control signal, or any combination of these signals (A feedback signal is transmitted back from the mobile to the base station, Paragraph 30, lines 19-21).

Regarding claim 14, Vialle teaches the method of claim 10, wherein  $L_m$  sets of weighting coefficients of transmission direction each having K coefficients are formed for each of M diverse groups of transmission channels in such a way that directions of arrival and the corresponding receiving powers of the received signal are estimated for each of M diverse groups of receiving channels (Sets of weighting coefficients that can be set equal to the

number of channels are formed for all transmission groups, the phase of the signal is adjusted accordingly to meet antenna diversity, and the corresponding received powers are estimated for each receive antenna to achieve maximum power in a transmission method that includes Quadrature Phase Shift Keying, Paragraph 44, lines 1-5, Paragraph 29, lines 1-8, Paragraph 30, lines 1-7 and 14-21, Paragraph 32, lines 17-23 and 26-28 and Figs. 3 and 4),  $L_{sub\ m}$  directions corresponding to  $L_{sub\ m}$  maximum average values of received signal power are selected for each of  $M$  diverse groups of receiving channels (The method of transmission is weighted to transmit the maximum power, Paragraph 33, lines 8-12),  $L_{sub\ m}$  sets of weighting coefficients of transmission direction each having  $K$  coefficients of transmission direction are formed for each of  $M$  diverse groups of transmission channels in  $L_m$  directions of signal arrival selected for a corresponding diverse group of reception channels in such a way that the reception quality of the signal transmitted from the base station to the mobile station is maximized (Sets of weighting coefficients that can be set equal to the number of channels are formed for all transmission groups, the phase of the signal is adjusted accordingly to meet antenna diversity, the corresponding received powers are estimated for each receive antenna to achieve maximum power in a transmission method that includes Quadrature Phase Shift Keying, and the method of transmission is weighted to transmit the maximum power, Paragraph 44, lines 1-5, Paragraph 29, lines 1-8, Paragraph 30, lines 1-7 and 14-21, Paragraph 32, lines 17-23 and 26-28, Paragraph 33, lines 8-12 and Figs. 3 and 4).

Regarding claim 15, Vialle teaches the method of claim 10, wherein channels of directional transmission are formed in such a way that in each channel of directional transmission  $K$  copies of an input signal of this channel of directional transmission are formed

and transmitted over a corresponding transmission channel once each copy of the input signal has been multiplied by the corresponding weighting coefficient of transmission direction of the respective set of weighting coefficients of transmission direction (**Correct copies of transmit signals, corresponding to each transmission channel, are transmitted once each copy has been formed from the set of FIR filters through mathematical formulas that include the multiplication of weighting coefficients by other factors for each of their corresponding channels, where “w” is the weighting coefficient that gets multiplied, Paragraph 27, lines 1-7 and Paragraph 33, lines 8-12).**

Regarding claim 16, Vialle teaches the method of claim 10, wherein all transmitted pilot signals for directional transmission and the information signal are mutually orthogonal or quasi-orthogonal (**The system is adaptable to be used in a Orthogonal Frequency Division Multiplexing method Paragraph 11, lines 4-8 and Paragraph 12, lines 4-6. Since the pilot signal and corrected information signal are exclusive but interference of these signals may take place, due to multipath fading, these 2 signals are quasi-orthogonal to one another, Paragraph 27, lines 1-10 and Paragraph 31, lines 1-4).**

Regarding claim 17, Vialle teaches the method of claim 3, wherein transfer functions of all K channels of directional transmission are estimated at the mobile station for each of M diverse groups of transmission channels using the transmitted pilot signals for transmit diversity in such a way that an estimate of transfer function of each channel of directional transmission is equal to Fourier transform of estimated impulse response of this channel of directional transmission (**Transfer functions are estimated at the receiver for each channel using pilot signals in a transmission method that includes transmit diversity, and a Hermitian**

transformation, which is a type of Fourier transformation, takes place on the impulse response obtained from the Filtered Impulse Response Filter to achieve maximum power, Paragraph 26, lines 7-10, Paragraph 31, lines 1-4 and 10-14 and Paragraphs 34-38).

Regarding claim 18, Vialle teaches the method of claim 1, wherein channels of signal spectrum correction are formed at the base station for each of M diverse groups of transmission channels for each of K channels of directional transmission in such a way that a transfer function of each channel of signal spectrum correction is equal to a complex conjugate of the corresponding estimated transfer function of the channel of directional transmission (Power is one of the weighting characteristics used for correction of the transmission signal, and since this characteristic is re-defined for each channel at the base station, the signal spectrum is corrected, a codebook (look-up table) being used in this case to adjust the method of transmission to use the maximum power, and complex weighting coefficients are derived from the transfer function in the transmission method, Paragraph 33, lines 4-6 and 8-12 and Paragraph 23, lines 3-7).

*Allowable Subject Matter*

7. Claims 8 and 9 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.
8. The following is a statement of reasons for the indication of allowable subject matter:

Regarding claim 8, Vialle teaches the limitations of claim 1. In the opinion of the examiner, all other prior art fails to teach Lm sets of weighting coefficients of transmission direction each having K- 1 weighting coefficients of transmission direction are formed at the mobile station for each of M diverse groups of transmission channels using the estimated impulse responses of M. K transmission channels of diverse groups in such a way that a spatial correlation matrix  $R_{sub\ m,n}$  is formed for each of M diverse groups of transmission channels for all of N resolvable paths of the transmitted pilot signals, where  $N \geq 1$ , as follows:

$$R_{sub\ m,n} = [h_{m,1,n} h_{m,2,n} \dots h_{m,K,n}]^* [h_{m,1,n} h_{m,2,n} \dots h_{m,K,n}]$$

where  $h_{sub\ m,k,n}$  is a coefficient of the estimated impulse response of transmission channel k of diverse group m corresponding to the resolvable path n of the transmitted pilot signals,  $m = 1, 2, \dots, M$ ,  $k = 1, 2, \dots, K$ ,  $n = 1, 2, \dots, N$ ,  $x^*$  is an operation of complex conjugation of x, the spatial correlation matrix  $R_{sub\ m}$  of all resolvable paths is formed for each of M diverse groups of transmission channels as follows:

The spatial correlation matrix  $R_{sub\ m} = \text{Summation of from } 1 \text{ to } N \text{ of the spatial correlation matrices } R_{sub\ m,n}$ , an averaged spatial correlation matrix  $R_{sub\ m}(i)$ , where  $i \geq 1$  is the number of an averaging step, is formed for each of M diverse groups of transmission channels as follows:

The matrix  $R_{sub\ m}(i) = \text{The matrix } R_{sub\ m} \text{ for } i = 1;$

$\alpha \times \text{The matrix } R_{sub\ m}(i-1) + (1-\alpha) \times R_{sub\ m} \text{ for } i \geq 2;$

where  $0 \leq \alpha \leq 1$  is an averaging coefficient, the averaged spatial correlation matrix  $R_{sub\ m}$



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$m(i)$  is decomposed into eigen values  $\Theta_{sub\ m, k}$  and corresponding eigen vectors  $V_{sub\ m, k}$ , where  $k = 1, 2, \dots, K$ , the maximum eigen value  $\Theta_{sub\ m, \max}$  is selected among eigen values  $\Theta_{sub\ m, k}$ . such eigen values  $\Theta_{sub\ m, j}$  are selected among all eigen values that  $\Theta_{sub\ m, j} \geq (\theta \times \Theta_{sub\ m, \max})$ , where  $0 \leq \theta \leq 1, j = 1, 2, \dots, L_{sub\ m}$ ,  $L_{sub\ m}$  is equal to the number of eigen values  $\Theta_{sub\ m, j}$  for which this condition is satisfied,  $L_{sub\ m}$  eigen vectors  $V_{sub\ m, j}$  corresponding to  $L_{sub\ m}$  selected eigen values  $\Theta_{sub\ m, j}$  are selected,  $L_{sub\ m}$  sets of weighting coefficients of transmission direction each having  $K-1$  weighting coefficients of transmission direction are formed as follows:

$W_{sub\ m, j, k} = (V_{sub\ m, j, k} / (V_{sub\ m, j, 1}))$ , where  $W_{sub\ m, j, k}$  is the  $k$ -th transmission direction weighting coefficient of the  $j$ -th set of transmission direction weighting coefficients of the  $m$ -th diverse group of transmission channels,  $V_{sub\ m, j, k}$  is the  $k$ -th element of the  $j$ -th eigen vector of the averaged spatial correlation matrix of the  $m$ -th diverse group of transmission channels,  $m = 1, 2, \dots, M, j = 1, 2, \dots, L_{sub\ m}, k = 2, 3, \dots, K$ .

Regarding claim 9, Vialle teaches the method of claim 1. In the opinion of the examiner, all other prior art fails to teach transfer functions of channels of directional transmission corresponding to each of  $L_m$  sets of weighting coefficients of transmission direction of all  $M$  diverse groups of transmission channels are estimated at the mobile station in such a way that an impulse response of each channel of directional transmission is formed as follows:

$H_{sub\ m, j} =$

*Summation of from 1 to K of  $(W_{sub\ m, j, k} \times h_{sub\ m, k})$ ,  $W_{sub\ m, j, 1}$  ident. 1,*

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where  $W_{sub\ m, j, k}$  is the  $k$ -th transmission direction weighting coefficient of the  $j$ -th set of transmission direction weighting coefficients of the  $m$ -th diverse group of transmission channels,  $m = 1, 2, \dots, M$ ,  $j = 1, 2, \dots, L_m$ ,  $k = 1, 2, \dots, K$ ,  $h_{sub\ m, k} = \text{Summation of from } 1 \text{ to } N \text{ of } (h_{sub\ m, k, n} \times \delta(1 - t_{sub\ n}))$  is an impulse response of the  $k$ -th transmission channel of the  $m$ -th diverse group of transmission channels, where  $h_{sub\ m, k, n}$  is a coefficient of the estimated impulse response of the  $k$ -th transmission channel of the  $m$ -th diverse group of transmission channels corresponding to the  $n$ -th resolvable path of transmitted pilot signals,  $t_{sub\ n}$  is a delay of the  $n$ -th resolvable path of transmitted pilot signals,  $m = 1, 2, \dots, M$ ,  $k = 1, 2, \dots, K$ ,  $n = 1, 2, \dots, N$ , an estimate of a transfer function of this channel of directional transmission is equal to the Fourier transform of the formed impulse response  $H_{sub\ m, j}$  of this channel of directional transmission.

9. Claims 19-22 would be allowable if rewritten or amended to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action.

10. The following is a statement of reasons for the indication of allowable subject matter:

Regarding claim 19, in the opinion of the examiner, all other prior art fails to teach an apparatus for data transmission that includes  $M$  blocks of directional transmission,  $M \cdot K$  summation blocks,  $M \cdot K$  analog transmitters,  $M \cdot K$  antenna elements, such that the second inputs of each of  $M$  blocks of directional transmission are inputs of the corresponding weighting coefficients of transmission direction, each of  $K$  outputs of each of  $M$  blocks of directional

transmission is connected to the second input of the corresponding block of summation, the first input of each of  $M$ ,  $K$  blocks of summation is an input of the corresponding pilot signal, outputs of blocks of summation are connected to inputs of the corresponding analog transmitters, their outputs are connected to inputs of the corresponding antenna elements, their outputs are outputs of the apparatus for data  $M$  transmission, which differs in that another *summation of from 1 to  $M$  for  $L_{sub\ m} - 1$*  blocks of directional transmission and *summation from 1 to  $M$  for  $L_{sub\ m}$*  blocks of signal spectrum correction are added, where the first input of each of *summation from 1 to  $M$  for  $L_{sub\ m}$*  blocks of signal spectrum correction is an input of the information signal, the second input of each of *summation from 1 to  $M$  for  $L_{sub\ m}$*  blocks of signal spectrum correction is an input of the corresponding transfer function of the channel of directional transmission, an output of each of *summation from 1 to  $M$  for  $L_{sub\ m}$*  blocks of signal spectrum correction is connected to the first input of the corresponding block of directional transmission, each of  $K$  outputs of each of *summation from 1 to  $M$  for  $L_{sub\ m} - 1$*  additional blocks of directional transmission is connected to  $(L_{sub\ m} - 1)$  additional second inputs of the corresponding block of summation, where  $m$  takes on the values from 1 to  $M$ .

Regarding claim 20, in the opinion of the examiner, all other prior art fails to teach an apparatus for data transmission that includes  $M$  blocks of directional transmission,  $M.K$  blocks of summation,  $M.K$  analog transmitters,  $M$ ,  $K$  antenna elements, such that the second inputs of each of  $M$  blocks of directional transmission are inputs of the corresponding weighting coefficients of transmission direction, each of  $K$  outputs of each of  $M$  blocks of directional transmission is connected to the second input of the corresponding block of summation, the first input of each of  $M$ ,  $K$  blocks of summation is an input of the corresponding pilot signal, outputs

of blocks of summation are connected to inputs of the corresponding analog transmitters, the outputs of which are connected to the inputs of the corresponding antenna elements, whose outputs are outputs of the apparatus for data transmission, which differs in that *summation of from 1 to M for Lsub m -1* additional blocks of directional transmission, *summation of from 1 to M for Lsub m* blocks of signal spectrum correction, and *summation of from 1 to M for Lsub m* summators are added, where the first input of each of *summation of from 1 to M for Lsub m* blocks of signal spectrum correction is an input of the information signal, the second input of each of *summation of from 1 to M for Lsub m* blocks of signal spectrum correction is an input of the corresponding transfer function of the channel of directional transmission, an output of each of *summation of from 1 to M for Lsub m* blocks of signal spectrum correction is connected to the first input of the corresponding summator, the second input of each of *summation of from 1 to M for Lsub m* summators is an input of the corresponding pilot signal for transmit diversity, an output of each of *summation of from 1 to M for Lsub m* summators is connected to the first input of the corresponding block of directional transmission, each of K outputs of each of *summation of from 1 to M for Lsub m -1* additional blocks of directional transmission is connected to *summation of from 1 to M for Lsub m -1* additional second inputs of the corresponding block of summation, where m takes on the values from 1 to M.

Regarding claim 21, in the opinion of the examiner, all other prior art fails to teach an apparatus for data transmission that includes M blocks of directional transmission, M. K blocks of summation, M. K analog transmitters, M. K antenna elements, such that outputs of each of M blocks of directional transmission are connected to inputs of the corresponding blocks of summation, an output of each of M. K blocks of summation is connected to an input of the

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corresponding analog transmitter, an output of each of M. K analog transmitters is connected to the first input of the corresponding antenna element, the first output of each of M.K antenna elements is an output of the apparatus for data transmission, which differs in that *summation of from 1 to M for Lsub m -1* additional blocks of directional transmission, *summation of from 1 to M for Lsub m* blocks of signal spectrum correction, *summation of from 1 to M for Lsub m* summators, M. K analog receivers, and M weighting coefficients of transmission direction forming blocks are added, where the first input of each of *summation of from 1 to M for Lsub m* blocks of signal spectrum correction is an input of the information signal, the second input of each of *summation of from 1 to M for Lsub m* blocks of signal spectrum correction is an input of the corresponding transfer function of channel of directional transmission, an output of each of *summation of from 1 to M for Lsub m* blocks of signal spectrum correction is connected to the first input of the corresponding summator, the second input of each of *summation of from 1 to M for Lsub m* summators is an input of the corresponding pilot signal for transmit diversity, an output of each of *summation of from 1 to M for Lsub m* summators is connected to the first input of the corresponding block of directional transmission, K second inputs of each of *summation of from 1 to M for Lsub m* blocks of directional transmission are connected to K corresponding outputs of the respective weighting coefficients of transmission direction forming block, outputs of each of *summation of from 1 to M for Lsub m -1* additional blocks of directional transmission are connected to additional inputs of the corresponding blocks of summation, the second input of each of M.K antenna elements is an input of the receiving signal, the second output of each of M. K antenna elements is connected to an input of the corresponding analog receiver, an output of each of M. K analog receivers is connected to the

corresponding input of the respective weighting coefficients of transmission direction forming blocks.

Regarding claim 22, in the opinion of the examiner, all other prior art fails to teach the apparatus of claim 19, 20 or 21, wherein the block of directional transmission consists of K multipliers, where combined first inputs of K multipliers are the first input of block of directional transmission, their second inputs are the second inputs of block of directional transmission, and their outputs are outputs of the block of directional transmission.

### ***Conclusion***

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

**US Patent No. 5,539,832** refers to a multi-channel signal separation using cross-polyspectra.

**US PG Publication 2003/0036359** refers to a mobile station loop-back signal processing.

**US PG Publication 2003/0020651** refers to a wireless packet switched communication systems and networks using adaptively steered antenna arrays.

**US Patent No. 6,907,270** refers to a method and apparatus for reduced rank channel estimation in a communication system.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to FRANK DONADO whose telephone number is (571) 270-5361.

The examiner can normally be reached on Monday-Thursday, 7:30 am -5 pm, alternate Fridays, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Rafael Perez-Gutierrez can be reached on 571-272-7915. The fax phone number for the organization where this application or proceeding is assigned is 571-270-5361.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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